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**NEW AND LITTLE KNOWN GASTROPODA FROM THE UPPER CRETACEOUS OF TENNESSEE.**

BY BRUCE WADE.

An announcement of the discovery of unusually well preserved Upper Cretaceous fossils in the Ripley formation on Coon Creek in McNairy County, Tennessee, was made in the *Contributions to Geology* of the March, 1917, number of the *Johns Hopkins University Circular*. A somewhat detailed description of the locality and a few preliminary observations on the fauna were made in the same article. The studies of this fauna have since been pursued further and more than 350 species have been recognized.

The Gastropoda of this fauna are especially interesting, since this class is so prolific and so well preserved. A systematic study of these gastropods has recently been submitted as a dissertation from the Geological Laboratory of the Johns Hopkins University. In this study 151 species of Gastropoda from the Coon Creek locality have been differentiated and described. As a result of the evidence furnished by this large assemblage of perfect or nearly perfect univalve shells, it has been found necessary, in order to classify all of these forms, to propose several new generic groups. Descriptions of some of the more interesting of these new genera and species have been published recently<sup>2</sup> and it is the purpose of the present paper to present several additional forms of especial interest from this locality.<sup>3</sup>

Family **CONIDÆ.**Genus **CONORBIS** Swainson.

**Conorbis mcnairyensis** n. sp. Pl. XVII, figs. 1, 2.

*Description.*—Shell very small and biconic in outline; spire elevated, its altitude equal to about half that of the entire shell; whorls abruptly

<sup>1</sup> Published by permission of Dr. A. H. Purdue, State Geologist of Tennessee.

<sup>2</sup> PROC. ACAD. NAT. SCI., PHILA., July, 1916, pp. 455-471, Pls. XXIII, XXIV. *Am. Jour. Sci.* (IV), Vol. 43, pp. 293-297, figs. 1, 2, 1917.

<sup>3</sup> The writer wishes to express his indebtedness to Prof. W. B. Clark and his associates in Paleontology, Prof. E. W. Berry and Dr. J. A. Gardner, under whose guidance this study has been conducted. The writer is also indebted to Drs. W. H. Dall, T. W. Stanton, L. W. Stephenson, C. W. Cooke, and J. B. Reeside, Jr., of the U. S. Geological Survey, and Dr. H. A. Pilsbry, of The Academy of Natural Sciences of Philadelphia, for the privilege of studying their collections, for the kindly interest they have shown in the work, and for their assistance in helping to determine the biological relations of some of these forms.

shouldered or strongly tabulated, the maximum diameter falling in front of the median horizontal, volutions closely appressed and increasing gradually in size, probably four in number in a perfect individual; sculpture subdued and irregular; well-defined axial costæ not developed; spirals low and crowded, about six in number on the penultima, and more than sixteen on the ultima, spirals crossed by numerous irregular, sharply incised incremental lines which give the surface of the shell a subcancellate aspect; suture impressed; body shouldered posteriorly and sloping gently and evenly in front; aperture narrow; margin of outer lip broken away; inner lip concave medially; columella slightly flexed near the anterior extremity; umbilicus indicated by a narrow depression along the outer margin of the reflected inner lip.

*Dimensions*.—Altitude 4.3 mm.; maximum diameter 2.5 mm.

This form is represented by a single specimen. The species has been referred to the genus *Conorbis* since it shows all the generic features revealed in the type of the genus, *Conus dormitor* (Sowerby)<sup>4</sup> from the Eocene of western Europe. The Tennessee form is probably the first typical *Conorbis* to be reported from the Upper Cretaceous. An imperfect individual from the Senonian of Ria Piabas, Brazil, has been described under the name of *Conorbis restitutus*,<sup>5</sup> but the correctness of this generic determination has been questioned by Cossmann.<sup>6</sup>

#### Family VOLUTIDÆ.

##### Genus HYLLUS n. gen.

*Etymology*: *Hyllus*, a son of Hercules.

*Type*: *Hyllus callilateras* n. sp.

Shell large and subovoid in outline; spire obtuse or only slightly elevated; whorls closely appressed, increasing in size rapidly to a much inflated body; protoconch unknown; sculpture absent, external surface free from ornamentation except for incremental lines which show through the glazed surface; sutures obscured by callus; body slightly inflated and sometimes flattened dorso-ventrally, gently constricted behind, and in front it slopes gradually into a broad, slightly curved short pillar; aperture broad and lenticular, distinctly notched in front or produced into a short canal, slightly notched posteriorly; outer lip simple and broadly arcuate; inner lip

<sup>4</sup> Cossmann, M., 1896, *Ess. de Pal. Comp.*, livr. II, p. 149, Pl. VIII, figs. 16 et 18,

<sup>5</sup> White, C. A., 1888, *Archiv de Museu Nacionale de Rio de Janeiro*, vol. VII.. p. 119, est. X, figs. 4, 5.

<sup>6</sup> Cossmann, M., *loc. cit.*, p. 150.

excavated near the anterior extremity; columella marked by one or two strong oblique columellar folds; parietal wall glazed with a callus which in some forms is quite heavy; anterior fasciole broad and obscured by a callus.

This genus is proposed for a group of Volutes represented by two species from Coon Creek and a third species from Owl Creek which are characterized by large, inornate shells with expanded bodies and low spires. This group is probably nearer *Liopeplum*<sup>7</sup> than any other described genus but differs from that genus very essentially in the character of the spire, the outline of the body, and further in the obliqueness and number of the columellar plaits. Another closely related group of Volutes in the Upper Cretaceous is represented by the species *Melo pyriformis* Forbes from the Arrialoor, South India,<sup>8</sup> a species which Cossmann has referred to the genus *Scaphella*.<sup>9</sup>

***Hyllus callilateris* n. sp.** Pl. XVII, figs. 5, 6.

*Description.*—Shell large and subovoid in outline, spire elevated but its height probably less than the length of the aperture; number of whorls unknown; volutions increasing in size with a fair degree of rapidity; apex broken away, protoconch unknown; sculpture absent, external surface free from ornamentation except incremental lines which show through the glazed surface, especially on the anterior fasciole; suture hidden by callus; body slightly flattened dorso-ventrally, somewhat inflated and sloping gently posteriorly and likewise anteriorly where it merges into a broad curved pillar which is marked by a wide, low anterior fasciole partly hidden by callus; aperture broad and lenticular, distinctly notched or canaliculate anteriorly but the posterior notch is not well defined; outer lip simple and well rounded; inner lip excavated near the anterior extremity; columella marked by a single strong oblique fold; parietal wall heavily calloused; callus deposited over practically the entire surface of the shell and very conspicuously developed on the side of the body opposite the aperture into a broad, thick, well-rounded ridge.

*Dimensions* (imperfect individual).—Altitude 97 mm.; length of aperture 67.3 mm.; maximum diameter 58 mm.

In 1860 Conrad<sup>10</sup> figured a form and referred to it in his index of

<sup>7</sup> Dall, W. H., 1890, *Trans. Wagner Free Inst. Sci.*, Vol. III, pt. I, p. 73.

<sup>8</sup> Stoliczka, F., 1868, *Geol. Survey India, Pal. Indica, Cret. Faunas South India*, Vol. II, p. 83, Pl. VI, figs. 9, 9a.

<sup>9</sup> Cossmann, M., 1899, *Ess. de Pal. Comp. livr.*, III, p. 127.

<sup>10</sup> Conrad, T. A., 1860, *JOUR. ACAD. NAT. SCI. PHILA.*, 2d ser., Vol. IV, Pl. XLVII, fig. 14, p. 298.

the figures of the plate as *Ancilla creticensis*, but there is no reference in his text to the species nor has mention of it been found elsewhere in his writings. This figure does not show all the shell features but it presents characteristics that seem sufficient to say that Conrad's form is a species of the new genus *Hyllus*.

The species, *Hyllus callilateris*, is the type of the genus and is represented in the present collection by one specimen which is well preserved except for the loss of the apex. The species is well characterized by the broad flat body with a heavy callus deposit on the body opposite the inner lip and further by the single columellar plait.

***Hyllus coloratus* n. sp. Pl. XVII, figs. 3, 4.**

*Description.*—Shell of medium size and ovoid in outline; length of aperture and anterior canal greater than the elevation of the spire; whorls of conch probably four in number and increasing in size with a fair degree of rapidity; sculpture absent, external surface smooth and free from ornamentation except for incremental lines which show through a brilliant glaze; suture indistinct, hidden by a glazed callus which coats the entire surface of the shell; body evenly rounded posteriorly and medially but gently constricted anteriorly into a short broad pillar which is marked by a gently elevated anterior fasciole formed by increments of the anterior siphonal notch; aperture lenticular, produced anteriorly into a short canal; posterior siphonal notch shallow and subangular, directly in front of posterior commissure, notch indicated behind margin of aperture by incremental lines; outer lip simple and smooth; inner lip excavated; columella marked by two strong oblique folds; parietal wall thinly washed with callus.

*Dimensions* (imperfect individual).—Altitude 5.2 mm.; maximum diameter 2.4 mm.

There are two specimens of this species and both are incomplete. One of these shows a dark yellow color banding which is fixed in the glaze of the external surface and is no doubt a remnant of an original color pattern. The species is well characterized by the two columellar folds which are conspicuous on the inner lip, the inornate external surface and further by the subelliptical outline of the shell. This species differs from *Hyllus callilateris* by being much smaller and having two columellar plaits instead of one and further by not having a heavy deposit of callus on the body opposite the inner lip.

Genus **FALSIFUSUS** Grabau.<sup>11</sup>

**Falsifusus mesozoicus** n. sp. Pl. XVII, figs. 11, 12.

*Description.*—Shell small and fragile, fusiform in outline, spire elevated and acute, pillar very long, slender and straight; elevation of spire much less than length of aperture and canal; angle of spire increasing with age; whorls closely appressed, five in number, whorls of spire sharply convex or subangular in cross-section, body inflated; protoconch small, smooth and trochoid, coiled thrice; sculpture of body axial and spiral; axial strong, about ten in number on the body; axial ribs angular and spinose on the keel of the shoulder of the body but well rounded or nodulated on the whorls of the spire; axial absent on the shoulder and obsolete on the base of the body; spiral sculpture elaborate and may be described in groups as follows: a half-dozen subequal liræ on the shoulder, three on the sides of the whorls of the spire, including the spiral which outlines the periphery; twice as many on the medial portion of the body with intercalated secondaries; four or five irregular and obscure spirals on the posterior portion of the base, four stronger equal and equispaced liræ upon the anterior portion of the base; about a dozen increasingly finer spirals upon the pillar; suture impressed and undulated by the costæ of the preceding whorl; body abruptly constricted anteriorly into a long, slender pillar; aperture narrow, ovate, produced in front into a long, narrow canal with proximate, parallel margins; outer lip thin and simple; inner lip excavated at the base of the body; columella smooth, slightly twisted at the entrance of the anterior canal; parietal wall thinly glazed.

*Dimensions.*—Altitude 20.4 mm.; maximum diameter 8.2 mm.

The slender and fragile shells of this species are well characterized by the spinose terminations of the axial along the shoulder angle of the body, the elaborate spiral sculpture and the slightly bent slender pillar. The Mæstrichtian species *Fusus bicinctus* Kaunhowen<sup>12</sup> from Belgium is probably a related species of this genus. Kaunhowen's species has a higher spire and a much longer pillar than the Tennessee species and resembles the type of the genus more closely. These two species are the first Upper Cretaceous forms to be referred to Grabau's genus *Falsifusus*.

<sup>11</sup> Grabau, A. W., 1904, "Phylogeny of Fusus and its Allies," *Smiths. Misc. Coll.*, Vol. XLIV, p. 80.

<sup>12</sup> Kaunhowen, F., 1897, *Pal. Abhandl.*, Achter Bd., p. 82, Taf. X, figs. 1, 2, 3, 4.

Genus **BOLTENELLA** n. gen.

*Etymology:* Name given in honor of Bolten who applied the name *Busycon* to the type genus of this family.

*Type:* *Boltenella excellans* n. sp.

Shell of medium size, thin, fulguroid in outline; elevation of spire less than the length of the aperture and anterior canal; whorls closely appressed and increasing rapidly in size; protoconch smooth and paucispiral, fairly large and bulbous but not greatly inflated; sculpture subdued, both axial and spiral elements present; aperture pyriform; outer lip simple; parietal wall washed with callus; columella reinforced near the entrance of the anterior canal; pillar slender, either straight or curved.

This new genus is proposed to include a group of forms known from two species, one from Coon Creek, represented by several well preserved individuals and another from the Upper Cretaceous of Vaals, Germany, well illustrated and described by Holzapfel. The German species, *Hemifusus coronatus* (Roemer) Holzapfel<sup>13</sup> has been variously assigned by different authors since the days of Roemer to such genera as *Pyrula*, *Fusus*, *Rapa*, *Tritonidea*, *Tudicla*, and lastly to *Hemifusus* by Holzapfel. The discovery of a related species in the Ripley formation of Tennessee is further evidence of the existence of a well defined group, characterized by a fulguroid outline, a large, paucispiral protoconch and further by the subdued spiral and axial ornamentation of the outer surface, as well as a slender pillar in front of an inflated body. The fulguroid outline and fairly large protoconch seem sufficient to tie the group to the family *Busyconidæ*, yet there are many features that suggest the *Fusidæ*. The genus *Boltenella* is probably intermediate between these two families but more nearly like the *Busyconidæ* yet not near enough to true *Busycon* to be included in the group *Protobusycon*<sup>14</sup> since it is a much smaller form with a different type of pillar and external ornamentation. Among the *Fusidæ* it resembles *Falsifusus* Grabau,<sup>15</sup> but that group is typically more slender. Its spire is elevated and acuminate and the pillar is very long and straight. It is not typically fulguroid in outline as is the group for which the name *Boltenella* is proposed.

<sup>13</sup> Holzapfel, E., 1888, *Palæontographica*, Bd. XXXIV, p. 105, Taf. XI, figs. 8-13.

<sup>14</sup> Type: *P. cretaceum* Wade, 1917, *Am. Jour. Sci.*, Vol. XLIII, No. 256, p. 293, figs. 1, 2.

<sup>15</sup> Grabau, A. W., 1904, *Smiths. Misc. Collections*, Vol. XLIV, p. 80, 81, fig. 4.

**Boltenella excellans** n. sp. Pl. XVIII, figs. 3, 4.

*Description.*—Shell of medium size and thin; elevation of the spire less than the length of the aperture; whorls closely appressed and strongly shouldered by a broad concave shelf, whorls five in number, increasing in size from a minute apical whorl to a much inflated body; protoconch fairly large and bulbous; smooth and naticoid, coiled two and a half times; sculpture well defined but somewhat subdued; axials elevated and low, well rounded and short, persisting on the whorls of the spire to the anterior suture but evanescing a little in front of the shoulder angle of the body, axial ribs nodulated on the body, nodes occurring directly upon the shoulder angle while the axials persist for a short distance across the shoulder; spiral sculpture low and fine, slightly irregular with secondary spirals developed in the interspiral depressions near the aperture; spirals microscopically roughened by the intersection of numerous incremental lines; suture appressed and undulated by the axial ribs of the preceding whorl; body much inflated, shouldered behind, rounded or globose in front, and merging into a long straight pillar which may be straight or curved; aperture broadly ovate, grooved at the posterior commissure and produced in front into a narrow canal; outer lip thin and simple; inner lip excavated at the base of the body; columella smooth, reinforced at the entrance of the anterior canal by a deposit of callus; parietal wall thinly glazed, outer margin of the wash sharply defined.

*Dimensions.*—Altitude 38.4 mm.; elevation of spire 13.5 mm.; maximum diameter 18.7 mm.

This species is represented in the Coon Creek collection by several well preserved specimens, a few of which show the protoconch. The species is characterized by fulguroid shells which are ornamented on the external surface both by axial and spiral sculpture. They have a broad, slightly concave shoulder and the angle of the shoulder is nodulated on the body by the axial elevations.

Genus **SCOBINA** n. gen.

*Etymology:* *Scobina*, a file or rasp, name applied because of the rasp-like character of the incremental serrations along the anterior carina of the type species.

*Type:* *Scobina bicarinata* n. sp.

Shell moderately large and strong, top-shaped in outline; spire acute at the apex, its elevation less than half the total altitude of the shell; protoconch scar small; whorls closely appressed, obliquely shouldered, whorls of spire unicarinate, body flattened along the

narrow peripheral region, abruptly constricted in front of the periphery; sculpture spiral, spinose and laminated in the type species; incrementals sinuous in character, forming a reentrant angle along the posterior keel; aperture subovate, produced in front into a narrow canal; outer lip sinuous at the shoulder angle; inner lip reflected, not always adnate to the body and pillar, a chink occasionally present between the inner lip and pillar; pillar slender and elongate often curved or bent near the anterior extremity.

This genus has an acute spire and is characterized by a highly inflated body with a narrow peripheral region abruptly constricted in front of this periphery. The pillar is long and variable. The sculpture is dominantly spiral with laminar, somewhat zig-zag incremental lines. This genus is proposed to include two known species, one from Coon Creek and another from both Ripley and Dumas, Mississippi, both of which are represented by several well preserved specimens that present generic features that cannot be included within the limits of any of the described groups. The general form of the genus suggests *Hercorhynchus*<sup>16</sup> or possibly *Pyrifusus*. However, the strong sinuations of the axials along the shoulder is a character by which it may be readily separated from any of the previously known Busyconidae. There is a tendency toward low, obtuse spires in most of the genera of this family, yet some forms, such as *Pyrifusus*, are acute at the apex. With age, however, this low angle of the spire greatly increases, a feature very characteristic of *Scobina*. The strongly inflated, bicarinate body of the South Indian Upper Cretaceous form *Rapa cancellata* (ex parte) Stoliczka<sup>17</sup> resembles *Scobina* somewhat but the South Indian form is umbilicate, and not acute spirally. *Rapa* has a well defined umbilicus. *Pyropsis* differs from *Scobina* in having a low spire and no laminar incremental ornamentation. These characters will also serve to separate *Scobina* from *Trochifusus*.<sup>18</sup>

*Scobina bicarinata* n. sp. Pl. XVIII, figs. 1, 2.

*Description.*—Shell of medium size and top-shaped; spire acute at the apex, its elevation less than half the total altitude of the shell; angle of spire increasing with age; whorls six in number, closely appressed, increasing in size to an inflated body, whorls of spire

<sup>16</sup> Conrad, T. A., 1860, JOUR. ACAD. NAT. SCI. PHILA., 2d ser., Vol. IV, p. 286, Pl. XLVI, fig. 4; 1868, Amer. Jour. Conch., Vol. IV, p. 247.

<sup>17</sup> Stoliczka, F., 1868, Geol. Survey India, Pal. Indica, Cret. Faunas South India, Vol. II, p. 154, Pl. XII, figs. 12-16.

<sup>18</sup> Gabb, W. M., 1876, Proc. ACAD. NAT. SCI., PHILA., p. 285.

strongly shouldered and unicarinate; protoconch scar small; body broad and angular, the peripheral area narrow, flattened, bicarinate, the posterior body slope broad and conspicuous, the anterior slope is a little more gentle and a little broader than the posterior slope, especially in old individuals; sculpture both axial and spiral, spiral ornamentation consisting of the two carinæ on the periphery and six or seven low spiral ridges on the anterior slope of the body and on the pillar; posterior slope of whorls free from well defined sculpture; spirals intersected by deeply angular and laminar axials which are irregularly spaced and about twenty or less in number on the body; spirals spinose at the intersections of the incrementals; spines strongest along the posterior carina, anterior carina an aggregation of six or seven strong spiral threads that terminate sharply at the incremental lines, making axials at these points finely serrate; three or four similar threads appear between the two carinæ on the peripheral area; on the anterior slope of the whorl spines are low or tuberculate; aperture ovate, slightly angular behind and produced in front into a long, narrow canal with proximate parallel margins; margin of outer lip thin, deeply angulated at the posterior carina, abruptly constricted at the base of the body; inner lip excavated medially, reflected and adnate on the body and the pillar on immature individuals but not in adults, a deep, broad and elongate cavity developed in mature forms between the inner lip and the pillar; columella smooth; pillar slender, slightly curved or bent in an irregular manner near the anterior extremity.

*Dimensions* (slightly imperfect individual).—Altitude 26.6 mm.; maximum diameter 25.2 mm.

This species is well characterized by its pyriform outline, and especially by its bicarinate widely expanded body which is ornamented with laminar spinose axial lines. It is common at Coon Creek and represented in the present collection by a number of individuals which show a wide variation in form and size. Further collecting at the type locality may result in the isolation of other species of this group. An undescribed tricarinate species of this genus occurs at Owl Creek, Mississippi.

Genus **LIROSOMA** Conrad.

**Lirosoma cretacea** n. sp. Pl. XVIII, figs. 5, 6.

*Description*.—Shell fairly large and stout, pyriform; spire low and obtuse, its elevation less than half the total altitude of the shell; whorls five to eight in number, strongly and evenly convex, rapidly

increasing in size; protoconch rather small, smooth and very low, coiled two and a half times, initial turn minute and completely immersed in the succeeding whorl, remaining nuclear turns very low and broadly rounded, becoming increasingly higher toward the close of the protoconch; sculpture very ornate, incremental striations very numerous and well developed in interspiral depressions but obsolete for the most part on the crests of the spiral fillets, axial ribbing irregular in strength and occurrence, tending to develop into varices at more or less regular intervals; spiral bands or fillets about fourteen in number on the body, becoming low and crowded on the pillar, fillets narrow, rectangular in cross-section, widely and irregularly spaced; suture sharply impressed; body well rounded, constricted in front into a narrow slightly curved pillar, aperture pyriform; outer lip broken away; inner lip excavated at the base of the body, reflected but adnate along the middle of the pillar; columella smooth, enlarged at the entrance of the anterior canal; parietal wash very thin.

*Dimensions* (immature individual).—Altitude 24.9 mm.; maximum diameter 14.8 mm.

This species is well characterized by its stout fusiform outline, deeply impressed suture and highly ornate external surface. Only two individuals are known. They were collected from Coon Creek and are the first representatives of this genus to be reported from the Cretaceous. It is interesting to find these shells in the American Cretaceous since the genus is already well known in the American Tertiary. *Lirosoma cretacea* resembles *L. sulcosa* Conrad<sup>19</sup>, the type of the genus which comes from the Chesapeake Miocene, in general form, lirate ornamentation and character of the protoconch, but differs widely from the Miocene species in detail of sculpture and in the presence of irregular axial ribs which tend to develop into varices at more or less regular intervals. The species *Tortifusus curvirostra* Conrad from the Miocene of North Carolina and Virginia is regarded by Cossmann<sup>20</sup> as another species of *Lirosoma*.

The genus *Ranularia* Schumacher is another group of forms which should be considered in determining the generic relations of the Upper Cretaceous species described above. The French Eocene form *Ranularia piraster* (Lamarck) which is figured and regarded by Cossmann<sup>21</sup> as very typical of that genus, has a stout fusiform

<sup>19</sup> Conrad, T. A., 1830, JOUR. ACAD. NAT. SCI. PHILA., Vol. VI, 1st ser., p. 220, Pl. IX, fig. 8; Martin, G. C., 1904, *Md. Geol. Survey*, Miocene, p. 183, Pl. XLVII fig. 1.

<sup>20</sup> Cossmann, M., 1901, *Ess. de Pal. Comp.*, livr. iv, p. 79.

<sup>21</sup> *Idem.*, 1903, livr. v, p. 97, Pl. III, fig. 12.

outline, lirate sculpture and varicose axialis, all of which present a general aspect which strongly suggests the Cretaceous species under discussion. *Ranularia piraster*, however, has a dentate inner margin on the outer lip, a feature characteristic of the Tritonidæ but not present on *Lirosoma cretacea* and uncommon in the Busyconidæ.

Family BUCCINIDÆ.

Genus **SEMINOLA** n. gen.

*Etymology:* *Seminoles*, a tribe of Indians who formerly lived in the southeastern coastal plain region.

*Type:* *Seminola crassa* n. sp.

Shell compact, of medium size or large, globose; spire low; whorls not very numerous, increasing rapidly in size to an inflated body; protoconch unknown; both axial and spiral sculpture developed, the axial more or less obsolete on the body of the adult; suture obscure or deeply impressed; body well rounded medially, constricted and folded inward at the base of the body where a deep sulcus, parallel to the spiral sculpture, separates the body from the pillar; aperture broad and subovate, produced anteriorly into a short, recurved canal; outer lip simple or varicose, a strong tooth-like projection occurring on the margin at the anterior extremity of the spiral sulcus at the base of the body; inner lip excavated medially; columella reinforced, marked by an oblique plication near the anterior extremity and along the margin of the anterior canal; parietal wall calloused, sometimes heavily; pillar broad and short, slightly recurved; umbilical chink shallow; anterior fasciole broad, oblique, heavily corrugated.

This genus is well characterized by globose shells of different sizes, having both spiral and axial sculpture variously developed. The pillar is broad and short, being separated from the body by a deep spiral sulcus that terminates with a tooth-like projection on the margin of the outer lip, a shell character which possibly indicates the former position of the eye-stalk of the animal. The genus is proposed to include five species heretofore unknown in the literature: two from Coon Creek, one from Owl Creek, and two from the Ripley of Texas; and one species from Pataula Creek, Georgia, described by Gabb under the name of *Nassa globosa*.<sup>22</sup> There is no figure of this species, but the type, which is imperfect, may be seen at the Museum of The Academy of Natural Sciences of Philadelphia. The generic deter-

<sup>22</sup> Gabb, W. M., 1876, PROC. ACAD. NAT. SCI. PHILA., p. 282.

mination of Gabb's species was questioned by Johnson<sup>23</sup> in 1905. The evidences furnished by recently discovered material from Coon Creek shows that these related species from the Ripley do not belong to the genus *Nassa* but represent a large, undescribed group of magnificent forms which belong to the family Buccinidæ. This group is no doubt near Meek's genus *Odontobasis*.<sup>24</sup> *Seminola* differs from *Odontobasis* in having a globose or ovoid form rather than a fusiform outline. Another closely related genus of the Buccinidæ is *Pseudoliva*<sup>25</sup> Swainson, represented in the Senonian by *Pseudoliva zitteli* Pethö<sup>26</sup> from Hungary. The spiral groove in *Pseudoliva* occurs well up on the body and is nothing more than a deep spiral sulcus in the sculpture pattern and differs very decidedly from the deep spiral sulcus at the base of the body of *Seminola*. The Nassidæ usually have a crenulate or dentate outer lip and lack the marginal fold on the anterior end of the columella and do not have such a deep spiral sulcus at the base of the body which terminates in a tooth on the outer lip of the aperture.

***Seminola crassa* n. sp.** Pl. XIX, figs. 6, 7.

*Description.*—Shell large and globose; spire low and obtuse, its elevation about one-third the total altitude, whorls six in number and increasing rapidly in size to a much inflated body; sculpture elaborate, axials sharply rounded, coarse and strong; twelve in number on the later whorls of the type, short and retractive, very prominent on the shoulders of the whorls but disappearing abruptly just in front of an undulating sutural band and persisting, though with somewhat diminished strength, to the anterior suture and on the early part of the body to the base; on the final half turn, however, restricted almost entirely to the posterior third; spiral sculpture low and irregular, consisting of a half-dozen equal and equi-spaced coarse and somewhat flattened cords upon the penult and twice as many on the early part of the ultima, secondary spirals are introduced near the base of the first half and these increase in prominence so that toward the aperture, they are almost as strong as the primaries; there are two or three feeble secondary spirals on the sutural band; suture deeply impressed, strongly canaliculate on the later volutions; body constricted posteriorly, sloping rapidly in

<sup>23</sup> Johnson, C. W., 1905, PROC. ACAD. NAT. SCI. PHILA., p. 23.

<sup>24</sup> Meek and Hayden, 1876, U. S. Geol. Survey of the Terr., Vol. IX, pp. 351-354, text figs. 41, 42, 43, Pl. 191, figs. 1, a, b, c.

<sup>25</sup> Cossmann, M., 1901, *Ess. de Pal. Comp.*, livr. IV, pp. 191, 192.

<sup>26</sup> Zittel, Text-book of Paleontology, English ed., 1913, Vol. II, p. 556, fig. 1012.

front to the base, where it is abruptly constricted or wrinkled, forming a conspicuous spiral sulcus which separates the body from the pillar; aperture subovate, grooved posteriorly and produced anteriorly into a short, broad, slightly recurved canal; outer lip thin and crenulated along the margin in harmony with the spiral sculpture, thickened or varicose in very old individuals; inner lip excavated and calloused; parietal wash very thick and heavy in old individuals; columella reinforced, marked by a very oblique fold near the anterior extremity and along the margin of the anterior canal; pillar short and broad; umbilical chink shallow; anterior fasciole a broad and oblique ridge registering the incremental stages of the anterior canal, extremity broadly and quite deeply emarginate.

*Dimensions* (immature individual).—Altitude 54.5 mm.; maximum diameter 35 mm.

This magnificent species is common at Coon Creek but even though the shells are thick and fairly strong the specimens are nearly always crushed as they occur in the matrix, so that perfect specimens are rarely obtained. The shells reach considerable dimensions; imperfect specimens in the collection show that some individuals had an altitude of about 80 mm. and a maximum diameter of about 50 mm. The species is well characterized by the retractive axialis which are unusually elevated and strongly rounded. The interaxials are unusual because they are so deep and narrow. The spiral sculpture consists of both primary and secondary cords. The peculiar spiral sulcus at the base of the body is conspicuous on the outer wall of the shell but produces little or no effect on the inner surface of the shell wall within the body cavity.

***Seminola solida* n. sp.** Pl. XIX, figs. 1, 2.

*Description*.—Shell of medium size and rather stout or coarse, globose in outline; spire low and obtuse, its elevation about one-third the total altitude of the shell; whorls five in number on an incomplete individual, rapidly increasing in size to an inflated body; sculpture elaborate, both axial and spiral, axial costæ seventeen to eighteen on the body, subequal and subequispaced, very narrow, abruptly elevated, somewhat incremental in character, terminating abruptly at the shoulder and diminishing in strength upon the anterior slope of the body; inter-costal spaces concave and not so wide as the costæ; spirals less coarse than axialis but overriding them; fillets ten in number on the ultima and two on the penultima, spirals equal and equispaced, more prominently elevated on the summits of the costals than in the inter-costal areas; an unornamented sutural

ridge developed just behind the shoulder and in front of the suture, closely appressed to the preceding whorl; suture impressed, crenulated by the costals of the preceding whorl; body abruptly constricted, cut off from the pillar by a conspicuous spiral sulcus; aperture pyriform, produced anteriorly into a short, sharply recurved canal; outer lip crenulated along the margin in harmony with the spirals; inner lip heavily calloused, excavated medially; columella reinforced, marked by a strong, oblique marginal fold; parietal wash heavy and terminating in a sharp line along its outer margin; umbilical chink shallow and obscure; anterior fasciole well defined, deeply emarginate at its extremity.

*Dimensions*.—Altitude 24.4 mm.; maximum diameter 19.4 mm.

This species is well characterized by its low spire and globose outline. It differs from *Seminola crassa* in that it is much smaller in size, in character of the pillar and in having long axial costæ parallel to the axis and persisting from the shoulder to well down on the anterior part of the body. The axial costæ of *Seminola crassa* are retractive and more deeply impressed, even in young individuals. *S. solida* has a pillar and marginal columellar fold much the same as Gabb's species of this genus, which was described under the name of *Nassa globosa*<sup>27</sup> but that species is much larger, its external ornamentation tends to become obsolete on the later whorls.

#### Family PURPURIDÆ.

Genus **ECPHORA** Conrad.

**Ecphora proquadricostata** n. sp. Pl. XVIII, fig. 7.

*Description*.—Shell small and fragile, umbilicate pyriform, spire depressed; whorls four or five in number and increasing rapidly in size; line of separation between conch and protoconch not sharply marked, two and a half nuclear turns, the initial turn is minute and completely submerged in the rounded second whorl which becomes increasingly higher toward its close, the shoulder angle is initiated at the beginning of the third turn and toward the close of this turn this angle develops into a spiral; sculpture spiral, consisting of four regularly spaced and abruptly elevated, narrow spiral ridges on the body whorl and only two on the volutions of the spire; interspiral spaces concave and profound, approximately twice as wide as the spirals, spiral depressions crossed by numerous, faint incremental lines; suture line appressed and following the second spiral; body

<sup>27</sup> Gabb, W. M., 1876, PROC. ACAD. NAT. SCI. PHILA., p. 282.

laterally expanded, equally strongly constricted anteriorly and posteriorly, forming a broad shoulder behind and a decided constriction at the base of the body; aperture subcircular, produced in front into a short, slightly curved canal with proximate parallel margins, outer lip thickened a little along the margin, serrated by the extremities of the four spiral ridges, shallow sulcus occurring on the inner surface beneath each spiral ridge of the outer surface, two low denticles developed between each pair of sulci along the inner margin of the outer lip; inner lip broadly excavated at the base of the body, sharply angulated at the entrance of the anterior canal; umbilicus profound; umbilical keel prominent, slightly varicose and flaring.

*Dimensions*.—Altitude 11.4 mm.; maximum diameter 9.5 mm.

This species is well characterized by its low but acute spire, its four strong spiral ridges and further by a slightly dentate inner margin of the outer lip. It is represented in the Coon Creek collection by four or five specimens, the one selected for the type is perfectly preserved and its generic relations can hardly be doubted. This elegant little species is of special interest since it is the first representative of this genus, so well known in the later Tertiary of the Atlantic Coastal Plain to be found in the Upper Cretaceous. No Eocene representatives are known from the Coastal Plain of the United States so that the discovery of a typical *Ecphora* in the Upper Cretaceous indicates that species of this well known genus may be expected in the earliest Tertiary marine sediments of the Southeastern United States. About a half-dozen species of *Ecphora* are known from the Oligocene and the Miocene and are given in 1903 in Cossmann's *Essais de Paléoconchologie Comparée* as follows:

Oligocene—

*Stenomphalus cancellatus* Sandberg, France.

*Rapana tampaensis* Dall, United States.

*Peristernia succincta* T. Woods, Australia.

Miocene—

*Ecphora quadricostata* Conrad, United States.

*Ecphora tricostata* Martin, United States.

*Stenomphalus wiechmanni* von Koenen, Germany.

*Rapana moulinsi* Brochon, France.

The protoconch of *Ecphora proquadricostata* is similar to that of *E. quadricostata* Conrad<sup>28</sup> the type of the genus, though different in

<sup>28</sup> Conrad, 1843, PROC. ACAD. NAT. SCI. PHILA., Vol. I, p. 310. See synonymy in Martin, G. C., 1904, Maryland Geol. Survey, Miocene, p. 207.

detail. Both are small, shelly, coiled two and a half times and not sharply differentiated from the conchs. Both nuclei are elevated or trochoid but that of the type species is the higher. The apical tips or initial points of the protoconchs of both species are immersed in the later nuclear turns but this is probably more pronounced in *E. proquadricostata*.

Genus **PARAMOREA** n. gen.

*Etymology:* *Ilapá*, near, *Morea*, a genus of gastropods.

*Type:* *Paramorea lirata* n. sp.

Shell small and porcellanous, ovate-conic in outline; spire acute, less than half the total altitude of the shell; protoconch scar small; conch solid and slightly glazed, paucispiral; axial sculpture absent; spiral sculpture well defined; aperture ovate, deeply notched in front; outer lip well rounded, its margin simple or slightly crenulated; inner lip excavated and thinly glazed; columella slender and marked by a feeble oblique plait or twist of the pillar near the anterior extremity; umbilical chink narrow, oblique and deep, canal short and broad.

This genus is proposed to include a single species from Coon Creek which seems to represent a group of univalves related to *Morea*. This species is well characterized by its sharp spiral sculpture, deeply notched aperture, and further by its very oblique and narrow umbilicus or umbilical chink with a general aspect and generic features that do not allow it to fit naturally into any known genus of related shells. The type of the genus *Morea*<sup>29</sup> was described from the Ripley formation. Two or three species other than the type also occur at that horizon so that it is not surprising to find another group related to this very unique genus in the Upper Cretaceous of the southeastern states. The genus *Paramorea* differs from *Morea* in having instead of a well defined umbilicus a narrow and oblique chink, and in the development of only spiral ornamentation instead of both spiral and axial, in the acute spire and in the absence of a strongly reflected inner lip such as that of *Morea*. In general aspect, i. e., the acute spire, strong spiral sculpture and narrow umbilicus this genus greatly resembles *Trichotropis* in features as presented by the recent North Atlantic species *Trichotropis borealis* Broderip and Sowerby,<sup>30</sup> but differs from that form in having a strong anterior notch or short open canal. In 1889, C. A. White described and figured an imperfect specimen from the Chico series of Shasta county, California, a species

<sup>29</sup> Conrad, T. A., 1860, JOUR. ACAD. NAT. SCI. PHILA., 2d ser., Vol. IV, p. 290, Pl. 46, fig. 30.

<sup>30</sup> Adams, H. and A., 1858. *Genera Recent Moll.*, Vol. I, p. 279, Pl. 29, fig. 6.

which he questionably referred to the genus *Stomatia*. This form, *Stomatia obstricta* White,<sup>31</sup> although it is represented by a cast, presents an outline together with a spiral ornamentation and an indication of an umbilical chink which suggest the genus *Paramorea*. Until more perfect specimens of the California species are known its generic position will probably remain uncertain.

*Paramorea lirata* n. sp. Pl. XVII, figs. 9, 10.

*Description*.—Shell small and porcellanous, ovate-conic in outline; spire acute, its elevation a little less than the length of the aperture; whorls closely appressed and shouldered; increasing in size with a fair degree of rapidity; protoconch scar small; sculpture sharply spiral, consisting of six well defined liræ on the penult and thirteen on the ultima, liræ strongest and most widely spaced on the posterior edge of the whorls, on the anterior portion of the body the spiral threads are closely spaced, the interspaces being narrower than the liræ, liræ intersected and slightly interrupted by incremental lines; suture distinct; body abruptly constricted posteriorly, forming a narrow shoulder, body convex medially and well rounded in front; aperture ovate, deeply notched anteriorly; outer lip evenly rounded, very slightly crenulated along the margin, subangular and a little thickened at the entrance of the anterior canal; inner lip excavated, parietal wall washed with a thin callus; columella slender, marked by a very feeble and oblique fold or twist of the pillar near the anterior extremity; umbilical chink very narrow and oblique, the last of the body spirals abnormal and constituting an obtuse umbilical keel; anterior canal short and open.

*Dimensions*.—Altitude 7.3 mm.; maximum diameter 4.7 mm.

Only two individuals of this elegant little species, which is the type of the genus, are known. They are well characterized by their spiral ornamentation, deeply notched aperture and further by the very oblique and narrow umbilical chink. The shell material is porcellanous and hard. One of the specimens has a brownish axial banding fixed in the shell material which seems to be a remnant of an ancient color pattern.

Family CERITHIDÆ.

Genus **NUDIVAGUS** n. gen.

*Etymology*: *Nudus*, unadorned; *vagus*, a straggler.

*Type*: *Nudivagus simplicus* n. sp.

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<sup>31</sup> White, C. A., 1889, *Bull. U. S. Geol. Survey*, No. 51, p. 18, Pl. IV, figs. 10, 11

Shell fairly large and simple, elongate conical; spire elevated and acute; aperture less than one-third as high as the entire shell; whorls of conch numerous, flattened and wide, increasing in size regularly and slowly; protoconch small and trochoid, coiled about three times, line between the conch and protoconch poorly defined; external surface usually smooth and glazed; sculpture absent and subdued; incremental varices occasionally present; suture simple and distinct; body abruptly constricted in front of the periphery into the short, curved pillar; aperture lenticular, angular behind and produced in front into a short canal; outer lip thin and simple; inner lip excavated; parietal wall glazed; columella smooth.

This genus is proposed to include a group of gastropods characterized by simple, elongate-conical shells with unadorned external surfaces. The aperture is subovate, considerably narrowed toward each end, terminating anteriorly in a short canal. Besides the type, two other species are known, one of which was described under the name of *Cerithium (Fibula ?) detectum*<sup>32</sup> by Stoliczka from the Arrialoor group of beds from the Upper Cretaceous of South India: the other under the name of *Pseudomelania astonensis*<sup>33</sup> by Huddleston from the upper division of the Inferior Oölite of England. *Nudivagus* differs from *Cerithium*, however, in the character of the aperture and in the absence of a strongly twisted columella and from *Clava* in having a non-plicate columella. *Nudivagus* is probably near *Gymnocerithium*<sup>34</sup> but differs from the latter in having less numerous whorls which are of greater height and less convexity. The new genus differs from *Pseudomelania* in the presence of an anterior canal. Meek's genus *Closteriscus*<sup>35</sup> includes elongate-conical forms somewhat similar to *Nudivagus* in outline and lack of external ornamentation, but the former, however, possesses well defined tooth-like, internal varices not found in the body cavities of the latter.

***Nudivagus simplicius* n. sp.** Pl. XIX, figs. 4, 5.

*Description.*—Shell fairly large and simple; thick but very friable, outline elongate-conical; spire elevated and acute, its elevation more than twice as great as the length of the aperture; whorls ten in number, closely appressed; obliquely flattened, increasing gradually and

<sup>32</sup> Stoliczka, F., 1868, *Geol. Survey of India, Pal. Indica*, Cret. Faunas Southern India, Vol. II, p. 192, Pl. XV, fig. 1.

<sup>33</sup> Huddleston, W. H., 1896, *Pal. Soc. London, Monogr. Inferior Oölite, Gastropoda*, p. 245, Pl. XVIII, figs. 8a, b.

<sup>34</sup> Cossmann, M., 1906, *Ess. de Pal. comp.*, livr. VII, p. 36, Pl. VII, fig. 17.

<sup>35</sup> Meek and Hayden, 1876, *U. S. Geol. Survey of the Terr., Inv. Pal.* Vol. IX, p. 306.

regularly in size from the apex to the ultima; protoconch not distinctly separate from the conch, consisting probably of three volutions which slope less steeply than do those of the conch; external surface highly polished; sculpture absent, excepting for very fine and crowded spirals and faint incrementals, discernible with a lens in the glaze of the external surface; suture indicated by a simple slightly impressed spiral line; body abruptly constricted in front of the periphery and produced into a narrow recurved pillar; aperture lenticular; terminating anteriorly in a narrow, rather long, recurved canal; outer lip thin and simple; inner lip excavated medially, washed with a thin callus; columella smooth.

*Dimensions* (slightly imperfect individual).—Altitude 76.2 mm.; maximum diameter 22.5 mm.

This species is the type of the genus and is well characterized by its broad, flat whorls and the fine, crowded spiral lines that show through the glaze of the external surface. The shells are relatively thick but not strong. They are fairly common at Coon Creek, but so fragile that not a single perfect specimen has as yet been recovered from the sediments.

Genus **ASTANDES** n. gen.

*Etymology:* Ἀστάνδης, a messenger.

*Type:* *Astandes densatus* n. sp.

Shell small and trochoid in outline; aperture of the type specimen less than half the entire length of the shell; protoconch small, smooth and trochoid; whorls of conch circular in cross-section and increasing gradually in size; external sculpture both axial and spiral, axial well rounded and retractive; spirals lirate; suture impressed; body equally constricted in front and behind; aperture D-shaped and produced in front into a short shallow canal; outer lip thickened and dentate; parietal wall washed with a callus; umbilicus imperforate.

This genus is very much like *Cerithioderma* Conrad<sup>36</sup> in general outline, the circular cross-section of the whorls and in the axial and spiral sculpture, but differs from it in the less acuminate spire and the imperforate umbilicus. It resembles *Paladmete* Gardner,<sup>37</sup> but differs from that group in having a short anterior canal. The genus is proposed to include a species recently discovered at Coon Creek and two other known species in the European Upper Cretaceous.

<sup>36</sup> Conrad, T. A., 1860, JOUR. ACAD. NAT. SCI. PHILA., 2d ser., Vol. IV, p. 295, Pl. 47, fig. 30. Cossmann, M., 1906, *Ess. de Pal. Comp.*, livr. VII, p. 191.

<sup>37</sup> Gardner, J. A., 1916, *Md. Geol. Survey*, Upper Cret., p. 412, Pl. XVIII, figs. 14, 15.

One of these occurs in the Aachen Cretaceous of Vaals, Germany, and was described in 1851 by Müller, and referred to the genus *Tritonium*,<sup>38</sup> the other is a closely related form from the Maestrichtian of Belgium which Kaunhowen<sup>39</sup> compares with Müller's species from Vaals, but does not apply a name to it. *Astandes* differs from *Tritonium* or *Nyctilochus* in lacking of true varicose axials and in a shorter and much less strongly developed anterior canal.

***Astandes densatus* n. sp.** Pl. XVII, figs. 7, 8.

*Description.*—Shell small and nearly trochoid in outline; spire moderately elevated and more than half the length of the entire shell; protoconch small and smooth; whorls of conch six in number, circular in cross-section and increasing in size gradually; external sculpture both axial and spiral; axials fairly coarse, well rounded and retractive, evanescing on the base of the body; axials overridden by numerous elevated spiral lines; aperture D-shaped, produced anteriorly into a short shallow canal; outer lip slightly thickened and dentate; parietal wall washed with a callus.

*Dimensions.*—Altitude 11.5 mm.; maximum diameter 7 mm.

This species is characterized by the elevated spiral lines which override the protractive axials and further by the dentate outer lip. It is represented in the present collection by several individuals. No closely related American species is known, but the Tennessee form may be compared with the Maestrichtian species *Tritonium cf. cretaceum* (Müller) Kaunhowen,<sup>40</sup> which resembles it very much in form of aperture and character of external ornamentation but differs in details of external sculpture.

#### Family SCALIDÆ.

Genus **ACIRSA** Mörch.

***Acirsa microstriata* n. sp.** Pl. XVIII, fig. 8.

*Description.*—Shell of medium size, thin and strong; form an elongate, simple, slender cone; spire acuminate; volutions eleven on the type individual which has the apical tip broken away, probably fourteen on the original, whorls increasing regularly in size from apex to ultima, volutions flattened laterally, penultima and ultima very slightly constricted toward the sutures; protoconch unknown;

<sup>38</sup> *Tritonium cretaceum* Holzapfel, 1888, *Palaeontographica*, Band xxxiv, 113, Taf. x, figs. 5-7.

<sup>39</sup> Kaunhowen, F., 1897, *Pal. Abhandl.* Acht. Bd., p. 77, Taf. ix, figs. 4, 4a; Taf. xiii, Fig. 12.

<sup>40</sup> Kaunhowen, F., 1898, *loc. cit.*

sculpture barely visible to the unaided eye, axial sculpture restricted to strong and conspicuous incremental lines, occurring at irregular intervals, and to low, obscure and unequal axial wrinkles on the periphery of the whorl; spiral sculpture microscopically fine but sharp, consisting of about fifteen closely spaced feebly impressed lines to each of the whorls of the spire, but about thirty-five on the sides and base of the body; suture simple and appressed, posterior edges of whorls very sharp in front of suture; peripheral angle obtuse, base of body broadly rounded; aperture holostomous, obliquely ovate, angulated at the posterior commissure; outer lip rounded and slightly effuse at the anterior, its curvature higher than that of the inner lip; inner lip smoothly glazed and reflected concealing the umbilical chink; parietal wash thin, columella smooth.

*Dimensions.*—Altitude 31.5 mm.; maximum diameter 9.9 mm.

Only one shell of this species is known and this individual aside from the loss of its apical tip is as strong and well preserved as if it were a recent shell. *Chemnitzia cerithiformis* Meek and Hayden<sup>41</sup> from the Fox Hills group of the Upper Missouri Cretaceous no doubt belongs to the same genus. In 1860, Meek and Hayden<sup>42</sup> in a check list referred this species to the genus *Scala* (*Acirsa*) but in their final description it was assigned to the genus *Chemnitzia*. After a study of Cossmann's very comprehensive work on the Scalidæ<sup>43</sup> and three species, including *Chemnitzia cerithiformis*, recently collected from Coon Creek, it seems that Meek and Hayden's species was an *Acirsa* and that the other two Tennessee species are congeneric.

***Acirsa corrugata* n. sp. Pl. XVIII, fig. 9.**

*Description.*—Shell small and slender; form elongate-conic, spire acuminate; whorls eleven in number, slightly convex and increasing in size regularly and very slowly; protoconch scar small; sculpture elaborate, consisting of both axial and spiral elements; axial elevations strong and crowded on the early whorls of the spire, but becoming lower and more widely spaced on the later volutions; spiral sculpture overriding the axials, but very obscure on their summits; spiral sculpture consisting of low, crowded thread-like liræ, sixteen to twenty in number on the later whorls of the spire and with slightly wider additional spirals on the base of the body; interspiral areas marked by very fine and regular pittings; suture distinctly impressed;

<sup>41</sup> Meek and Hayden, 1876, *U. S. Geol. Survey of the Terr.*, Vol. IX, p. 339, Pl. 32, figs. 10a, b.

<sup>42</sup> Meek and Hayden, 1860, *PROC. ACAD. NAT. SCI. PHILA.*, XII, p. 185.

<sup>43</sup> Cossmann, M., 1912, *Ess. de Pal. Comp.*, pp. 16-102.

body very slightly constricted in front of the posterior margin; peripheral angle obtuse, base of body obliquely flattened or very broadly rounded; aperture holostomous, broadly and obliquely ovate, angulated at the posterior commissure; outer lip thin and simple, slightly patulous in front; inner lip excavated medially, thin and reflected, adnate to the body wall; columella smooth.

*Dimensions.*—Altitude 14.7 mm.; maximum diameter 4.1 mm.

This species is well characterized by its sharply defined axial costæ which are crowded on the early whorls of the spire but become more widely spaced on the later volutions, and further, the species is characterized by fine regular pittings in the interspiral spaces. Both *Acirsa corrugata* and *Acirsa microstriata* differ from *Acirsa cerithiformis* M. and H.<sup>44</sup> in the more elongate and slender outline and the details of the external ornamentation. *Acirsa corrugata* is smaller than *Acirsa microstriata* and unlike the latter exhibits a well developed axial sculpture over the entire shell.

The very elegantly ornamented species *Scalaria dense-striata* Kaunhowen,<sup>45</sup> from the Mæstrichtian of western Europe is probably a member of the genus *Acirsa* and may be compared with *Acirsa corrugata*.

Genus **HEMIACIRSA** de Boury.

*Hemiacirsa cretacea* n. sp. Pl. XIX, fig. 3.

*Description.*—Shell fairly large for the group, slender, turrited and conical in outline; spire acuminate; spire of the type slightly curved, possibly an individual characteristic due to three accidents in the life of the animal, each of which resulted in the breaking of the shell (as scars on the type specimen show) on the same side of the spire or possibly a specific character of this many-whorled form; whorls flattened, very closely appressed posteriorly, less tightly coiled toward the aperture; whorls twelve and a half on the imperfect type, at least two have been broken away, volutions increasing gradually in size; protoconch unknown; sculpture dominantly axial, axial costæ abruptly elevated and subangular on the crests, somewhat flexuous, costæ sixteen in number on the body of the type, regularly spaced, persistent from suture to suture on the whorls of the spire, interaxial spaces concave and a little wider than the costæ; spiral sculpture subdued but well defined in the interaxial depressions,

<sup>44</sup> Meek and Hayden, 1876, *U. S. Geol. Survey of the Terr.*, Vol. IX, p. 339, Pl. 32, figs. 10, a, b.

<sup>45</sup> Kaunhowen, F., 1897, *Palæontol. Abhandl.*, Neue Folge, Bd. IV, p. 43, Taf. III. Figs. 3, 4.

consisting of eleven on the body whorl and about the same number on the whorls of the spire; spiral lines on base of body very faint; suture impressed; base of body nearly flat; angular edge between base and sides of body well rounded; aperture ovate; margin of outer lip broken away; inner lip strongly and smoothly excavated medially; parietal wall washed with a thin glaze of callus; columella smooth.

*Dimensions* (apex of individual broken away).—Altitude 39.4 mm.; maximum diameter 11.1 mm.

This species is well characterized by its long, slender, rather large spire, and its flattened base, by its well defined axial costæ but obscure spirals. Whether the bend in the spire is an individual or specific character of this many-whorled species cannot be determined without additional material. Only one specimen is known at present but it is of special significance since it is the first evidence of the presence of this genus in the Upper Cretaceous. In Europe a number of species of *Hemiacirsa* have been reported ranging in age from the Montian<sup>46</sup> up to the recent species now living in the Gulf of Lyons. One species only is known from the Eastern United States. This is *Hemiacirsa perlaqueata* (Conrad) Cossmann,<sup>47</sup> a form originally described as a *Turritella* by Conrad,<sup>48</sup> later referred to the genus *Trachyrhynchus* Mörch by Martin<sup>49</sup> and finally to the genus *Hemiacirsa* by Cossmann in 1912.

#### Family PYRAMIDELLIDÆ.

Genus **CREONELLA** n. gen.

*Etymology*: A diminutive of Creon, king of Corinth.

*Type*: *Creonella triplicata* n. sp.

Shell small and smooth, in outline a simple, slender cone; whorls closely appressed and increasing in size slowly; whorls of spire generally flat and narrow; protoconch very small and heterostrophous with only two volutions; sculpture absent except for microscopic incremental lines in the glaze of the external surface; suture sharply impressed; body well rounded in front; aperture ovate; outer lip thin and simple, inner surface of the outer wall of the body strongly lirate; inner lip excavated medially; columella marked by two plaits, the posterior of which is the stronger; just behind the strong colu-

<sup>46</sup> Cossmann, M., 1912, *Ess. de Pal. Comp.*, livr. IX, pp. 97, 98.

<sup>47</sup> *Ibid.*, p. 97.

<sup>48</sup> *Turritella perlaqueata* Conrad, 1841, *PROC. ACAD. NAT. SCI. PHILA.*, Vol. I, p. 32.

<sup>49</sup> *Trachyrhynchus perlaqueatus* Martin, 1904, *Miocene Text, Md. Geol. Survey*, p. 239, Pl. LVII, fig. 9.

mellar plait on the body is another plait similar to a columellar fold; parietal wall glazed with callus; umbilicus imperforate.

This genus is well characterized by three conspicuous folds on the inner lip. The most posterior of these folds is situated on the body of the preceding whorl and the other two occur on the columella. The posterior one of the columellar plaits is the stronger and on either side of it there is a deep columellar sulcus. The genus is probably near *Pyramidella*, but the umbilicus of that genus is typically imperforate. The genus *Creonella* is proposed for a group represented by two species from Coon Creek which are unlike any known species of this family in either the Upper Cretaceous or the early Tertiary. A representative of the genus *Obeliscus*<sup>50</sup> which occurs at Coon Creek and also in the Monmouth of New Jersey, has a single columellar plait, otherwise, in simple, slender, conical forms of the inornate shells, the two groups resemble each other very much.

***Creonella triplicata* n. sp.** Pl. XIX, fig. 8.

*Description*.—Shell small and slender, in outline a very sharp cone; spire acuminate, angle of spire constant whorls closely appressed, numerous and narrow, seven in the imperfect type; probably almost twice as many in a perfect form; sculpture absent except for protrusive incrementals of irregular strength and spacing that scar the glazed external surface; suture distinctly impressed; body very abruptly constricted in front of the periphery; peripheral angle well rounded; aperture narrow, outer lip broken away; inner surface of labrum corrugated within, with about half a dozen prominent liræ, subequal, closely and evenly spaced; columella marked by two strong transverse folds behind which and on the body is another fold, the posterior of the columellar plaits is the strongest of these three plaits, on either side of the strong columellar fold are two deep spiral sulci around the columella.

*Dimensions* (imperfect individual).—Altitude 14.4 mm.; maximum diameter 3.3 mm.

This species is well characterized by its narrow, numerous whorls and its very sharp, strongly impressed suture. The species is known from only two specimens neither of which is perfect, but sufficiently preserved to show all characteristic features.

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<sup>50</sup> *Obeliscus canellus* Whitfield, 1892, *Mon. U. S. Geol. Survey*, Vol. XVIII, p. 151, Pl. 19, fig. 1.

## EXPLANATION OF PLATES XVII-XIX.

PLATE XVII.—Figs. 1, 2. *Conorbis mcnairyensis* n. sp.

1. Front view. x4.
2. Rear view. x4.

Figs. 3, 4. *Hyllus coloratus* n. gen. et sp.

3. Front view. Nat. size.
4. Rear view of another individual. Nat. size.

Figs. 5, 6. *Hyllus callilateris* n. gen. et sp.

5. Front view. Nat. size.
6. Rear view. Nat. size.

Fig. 7, 8. *Astandes densatus* n. gen. et sp.

7. Front view. x3.
8. Rear view. x3.

Figs. 9, 10. *Paramorea lirata* n. gen. et sp.

9. Front view. x4.
10. Rear view. x4.

Figs. 11, 12. *Falsifusus mesozoicus* n. sp.

11. Front view. x3.
12. Rear view. x3.

PLATE XVIII.—Figs. 1, 2. *Scobina bicarinata* n. gen. et sp.

1. Rear view. x2.
2. Front view. x2.

Figs. 3, 4. *Boltenella excellens* n. gen. et sp.

3. Front view. x2.
4. Rear view. x2.

Figs. 5, 6. *Lirosoma cretacea* n. sp.

5. Front view. x2.
6. Front view of a smaller individual. x2.

Fig. 7. *Ecphora proquadricostata* n. sp.

- Front view. x3.

Fig. 8. *Acirsa microstriata* n. sp.

- Front view. x2.

Fig. 9. *Acirsa corrugata* n. sp.

- Front view. x3.

PLATE XIX.—Figs. 1, 2. *Seminola solida* n. gen. et sp.

1. Front view. x3.
2. Rear view. x3.

Fig. 3. *Hemiacirsa cretacea* n. sp.

- Front view. x2.

Figs. 4, 5. *Nudivagus simplicus* n. gen. et sp.

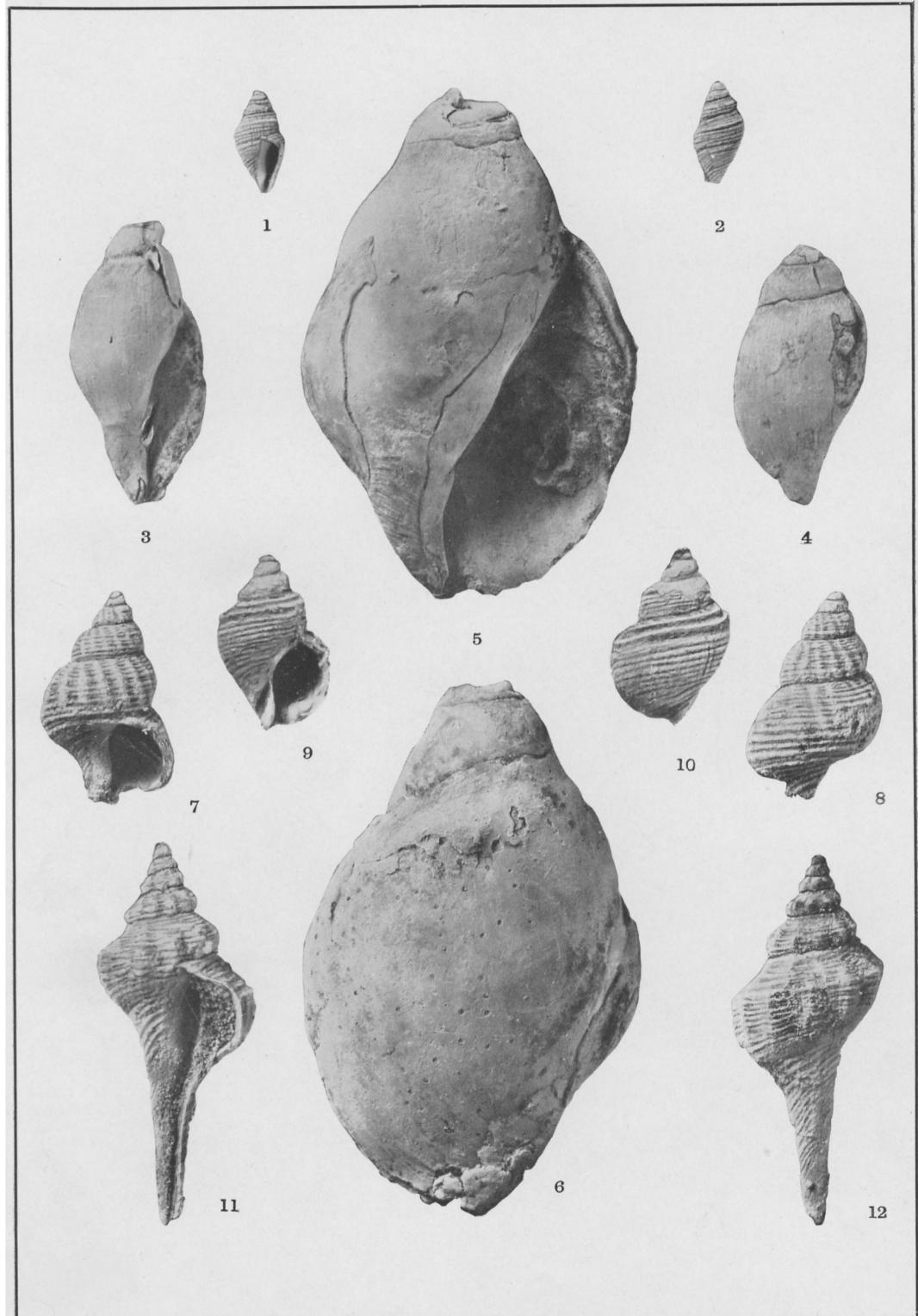
4. Front view. Nat. size.
5. Front view of a larger individual. Nat. size.

Figs. 6, 7. *Seminola crassa* n. gen. et sp.

6. Front view. x1½.
7. Rear view. x1½.

Fig. 8. *Creonella triplicata* n. gen. et sp.

- Front view. x2.



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